

an absorbance of the resultant solution is measured using a UV-visible spectrophotometer at 606 nm for Evans blue.

Please add the following new claim 21:

21. (New) The aqueous solution according to claim 1, wherein the azo dye is amaranth.

### REMARKS

Claims 1-21 are in this case. Claims 2, 11, 18 and 19 have been amended, and new claim 21 has been added. The Examiner indicated in the Final Office Action (Paper No. 10) that claim 11 would be allowable if rewritten in independent form. Therefore, claim 11 has been amended to include all of the limitations of base claim 1 and any intervening claims.

Support for the claim amendments and for the new claim can be found throughout the specification, *e.g.*, page 5, lines 12-15, 17-25; page 6, lines 1-5 and 7-14; page 8, lines 12-14; page 10, lines 1-14; and claim 2 as filed. Applicants respectfully request consideration of the claims in light of the amendments and remarks made herein.

### Rejections Under 35 U.S.C. § 102(b)

Claims 1, 7-9 and 12 have been rejected under 35 U.S.C. § 102(b) as allegedly anticipated by U.S. Patent No. 5,397,710 to Steinmen ("Steinman").

In addition to the arguments presented in applicants' previous response filed on August 27, 2002 ("Response"), applicants note that the azo dyes recited in Steinman are all dihydroxyarylazo compounds. Neither amaranth nor Evans blue, the specifically recited azo compounds of the present invention, is such a compound. Thus, applicants respectfully submit that the present claims are not anticipated by Steinman. Therefore, as the rejection

under 35 U.S.C. § 102(b) has been overcome, applicants respectfully request that it be withdrawn.

Rejections Under 35 U.S.C. § 103(a)

Claims 1-10 and 12-20 have been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Hofmann et al. (1998, *Environmental Technology* 19:761-773; “Hofmann”) or Knechtel (1978, *Analytical Chemistry* 50(2):202-205; “Knechtel”) in view of U.S. Patent No. 4,880,556 to Hutchings (“Hutchings”). Applicants respectfully traverse.

As stated in the Response, Hofmann does not teach the use of a borate buffer. Furthermore, Hofmann teaches away from the use of amaranth for determining chlorine dioxide concentration, as it suggests that the amaranth method should be avoided when permanganate is present in a water sample (Hofmann, page 770, Paragraphs 1 and 2). Similarly, Knechtel does not teach the use of a borate buffer.

Additionally, as pointed out in the previous Response, Hutchings discloses cleaner compositions and therefore is non-analogous art to Hofmann and Knechtel. Therefore, one of ordinary skill in the art would not be motivated to combine the teachings of Hutchings with those of Hofmann and Knechtel to arrive at the present invention. Furthermore, Hutchings in no way teaches a method or composition for determining a chlorine dioxide concentration in a water sample.

As alleged in the Final Office Action, Example 8 of Hutchings teaches that the concentration of chlorine dioxide is affected by varying concentrations of borate buffer, and that therefore it would have been clear to one of ordinary skill in the art that the borate buffer would prevent the conversion of chlorite to chlorine dioxide (Final Office Action, page 7). However, applicants respectfully submit that one of ordinary skill in the art would not be motivated to combine the teachings of Hutchings with those of Hofmann and Knechtel. A

reference is from an analogous art if either it is "within the field of the inventor's endeavor" or if it "is reasonably pertinent to the particular problem with which the inventor was involved." *In re Paulsen*, 30 F3d 1475, 1481 (Fed Cir 1994); *Heidelberger Druckmaschinen AG v Hantscho Commercial Products*, 21 F3d 1068, 1972 (Fed Cir 1994); *In re Deminski*, 796 F2d 436, 442 (Fed Cir 1986). Because Hutchings is directed to cleaner compositions for use in household and janitorial cleaning, there would be no motivation for one of ordinary skill in the art of determining a chlorine dioxide concentration to look to Hutchings for useful information in developing a composition and method for determining a chlorine dioxide concentration. Thus, applicants respectfully submit that the claims as amended are not obvious over Hofmann or Knechtel in view of Hutchings. Therefore, as the claim rejection under 35 U.S.C. § 103(a) has been overcome, applicants respectfully request that it be withdrawn.

**CONCLUSION**

For at least the foregoing reasons, applicants respectfully submit that the claims are now in condition for allowance, early notice of which is earnestly sought..

No fee, besides the fee for an additional claim, and the fee for the extension of time to file this RCE application, is believed to be due for this amendment. Should any fee be required, please charge such fee to Deposit Account No. 16-1150.

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Respectfully submitted,

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Enclosures

## **Appendix A**

*Marked-up Version of the Amendments to Claim 42*

*U.S. Patent Application Serial No. 10/351,904*

*Attorney Docket No. 3006-041-999*

2. (Amended) The aqueous solution according to claim 1, wherein the azo dye is **[amaranth or] Evans blue.**
11. (Amended) **An [The] aqueous solution [according to claim 9] comprising Evans blue azo dye present at a concentration of about  $5 \times 10^{-4}$  mol/l, a borate buffer, aqueous ammonia present at a concentration of about  $1.5 \times 10^{-2}$  mol/l, and a sodium salt of EDTA present at a concentration of about 1 g/l,** wherein the aqueous solution contains about  $5 \times 10^{-2}$  mol/l of borate[, about  $1.5 \times 10^{-2}$  mol/l of aqueous ammonia as the masking agent,] **and the azo dye changes its coloration or coloration intensity in the presence of chlorine dioxide [about  $5 \times 10^{-4}$  mol/l of Evans blue as the azo dye].**
18. (Amended) A process for determining a residual chlorine dioxide content in industrial water or drinking water after treatment or in distribution circuits, comprising the steps of:
- placing the water to be analyzed in contact with the aqueous solution of claim 11,
- wherein a volume ratio:
- the water to be analyzed / the aqueous solution
- is between about 10 and about 30; and
- measuring an absorbance of the resultant solution using a UV-visible spectrophotometer at a specific wavelength of the azo dye **chosen**.

19. (Amended) The process according to claim 18, wherein  
about 10 ml of the aqueous solution are placed into a 250-ml graduated flask and  
made up to the graduation mark with the water to be analyzed; and  
an absorbance of the resultant solution is measured using a UV-visible  
spectrophotometer [at **521 nm for amaranth or** at 606 nm for Evans blue.

## **Appendix B**

*Clean Versions of All Claims (1-19) as Pending  
U.S. Patent Application Serial No. 09/394,647  
Attorney Docket No. 2988-651-999*

1. An aqueous solution comprising an azo dye, a borate buffer and one or more masking agents, wherein the azo dye changes its coloration or coloration intensity in the presence of chlorine dioxide.
2. (Amended) The aqueous solution according to claim 1, wherein the azo dye is Evans blue.
3. The aqueous solution according to claim 1, wherein the azo dye is present at a concentration of between about  $1 \times 10^{-6}$  and about  $1 \times 10^{-3}$  mol/liter.
4. The aqueous solution according to claim 1, wherein the azo dye is present at a concentration of between about  $2 \times 10^{-5}$  and about  $8 \times 10^{-4}$  mol/liter.
5. The aqueous solution according to claim 1, wherein the masking agent is aqueous ammonia.
6. The aqueous solution according to claim 1, wherein the borate is present at a concentration of between about  $5 \times 10^{-3}$  and about  $1 \times 10^{-1}$  mol/liter.
7. The aqueous solution according to claim 1, further comprising one or more metal-chelating agents.

8. The aqueous solution according to claim 7, wherein the metal-chelating agent is a sodium salt of EDTA.

9. The aqueous solution according to claim 8, wherein the sodium salt of EDTA is present at a concentration of between about 0.5 and about 2 g/liter.

10. The aqueous solution according to claim 9, wherein the aqueous solution contains about  $5 \times 10^{-2}$  mol/l of borate, about  $1.5 \times 10^{-2}$  mol/l of aqueous ammonia as the masking agent, about 1 g/l of sodium salt of EDTA and about  $2 \times 10^{-4}$  mol/l of amaranth as the azo dye.

11. (Amended) An aqueous solution comprising Evans blue azo dye present at a concentration of about  $5 \times 10^{-4}$  mol/l, a borate buffer, aqueous ammonia present at a concentration of about  $1.5 \times 10^{-2}$  mol/l, and a sodium salt of EDTA present at a concentration of about 1 g/l, wherein the aqueous solution contains about  $5 \times 10^{-2}$  mol/l of borate and the azo dye changes its coloration or coloration intensity in the presence of chlorine dioxide.

12. A process for manufacturing the aqueous solution according to one of claims 1 through 11, comprising the steps of:

(a) introducing the azo dye, the masking agent(s) and the borate buffer solution into a container containing a sufficient amount of double-deionized water;

(b) optionally adding the chelating agent predissolved in double-deionized water with stirring; and



- (c) making up the solution to a desired volume with double-deionized water.
13. The process according to claim 12 further comprising the steps of:
- (i) dissolving the azo dye in double-deionized water;
  - (ii) introducing into a container the solution prepared in (i), followed by a borate buffer solution, and finally a solution containing one or more masking agents;
  - (iii) adding double-deionized water and measuring pH;
  - (iv) adjusting pH to about 9.2, if necessary, using concentrated aqueous ammonia solution;
  - (v) optionally adding the chelating agent with stirring; and
  - (vi) making up the solution to a desired volume with double-deionized water.
14. The process according to claim 13, wherein the concentrated aqueous ammonia solution at about 28% (w/w) is used in the step (ii) as a masking agent and in the step (iv).
15. The process according to claim 14 further comprising the steps of:
- (i) dissolving either about 121.2 mg of amaranth [Ref. A-1016(97) Sigma] or about 56.5 mg of Evans blue (Ref. 20,633-4, Aldrich) in about 100 ml of double-deionized water;
  - (ii) dissolving about 3.09 g of boric acid in 500 ml of 0.1 M KCl solution and mixing it to homogeneity to prepare about  $5 \times 10^{-2}$  M borate buffer;

(iii) successively introducing into a one-liter flask, the amaranth or Evans blue solution prepared in (i), the borate buffer solution prepared in (ii), and about 1 ml of about 28% (w/w) aqueous ammonia solution;

(iv) adding double-deionized water and measuring pH;

(v) adjusting pH to about 9.2 using about 28% (w/w) aqueous ammonia solution;

(vi) adding about 1 g of sodium salt of EDTA with stirring until it completely dissolves; and

(vii) transferring the solution prepared in (vi) into a 1000-ml graduated flask and making up the total volume to the graduation mark with double-deionized water.

16. A process for determining a residual chlorine dioxide content in industrial water or drinking water after treatment or in distribution circuits, comprising the steps of:

placing the water to be analyzed in contact with the aqueous solution prepared by the process according to claim 12; and

measuring an absorbance of the resultant solution using a UV-visible spectrophotometer at a specific wavelength of the azo dye chosen.

17. The process according to claim 16, wherein a volume ratio:

the water to be analyzed/the aqueous solution  
is between about 10 and about 30.

18. (Amended) A process for determining a residual chlorine dioxide content in industrial water or drinking water after treatment or in distribution circuits, comprising the steps of:

placing the water to be analyzed in contact with the aqueous solution of claim 11,  
wherein a volume ratio:

the water to be analyzed / the aqueous solution

is between about 10 and about 30; and

measuring an absorbance of the resultant solution using a UV-visible  
spectrophotometer at a specific wavelength of the azo dye chosen.

19. (Amended) The process according to claim 18, wherein  
about 10 ml of the aqueous solution are placed into a 250-ml graduated flask and  
made up to the graduation mark with the water to be analyzed; and  
an absorbance of the resultant solution is measured using a UV-visible  
spectrophotometer at 606 nm for Evans blue.

20. The process according to claim 19, wherein an absorbance is measured using, as a  
reference, the water to be analyzed to which purified and crystallized sodium thiosulphate has  
been added in excess of the amount required to reduce any oxidizing agents present in the  
water.

21. (New) The aqueous solution according to claim 1, wherein the azo dye is amaranth.